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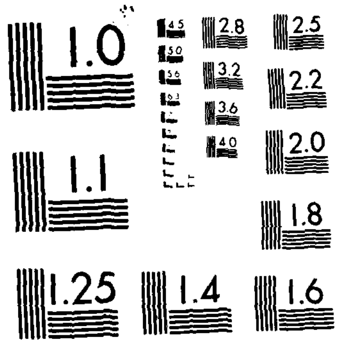

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Shoal Material

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This study describes environmental impacts of the propsed dredging of Stamford Harbor, Conn. This study in dredging lists biological, physical, chemical impacts.

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FINAL ENVIRONMENTAL REPORT

ENVIRONMENTAL IMPACTS OF PROPOSED MAINTENANCE DREDGING OF STAMFORD HARBOR, CONNECTICUT AND DISPOSAL AT EATONS NECK DISPOSAL SITE LONG ISLAND SOUND

SUBMITTED TO

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS

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JUNE, 1975

TABLE OF CONTENTS

PAGE NO.

LIST OF FIGURES

LIST OF TABLES

SUMMARY SHEET

1. Name of Action: (x) Administrative ( ) Legislative

2. Description of Action: The proposed action involves the dredging of Stamford Harbor, Connecticut with the dredged material being disposed of at the Eatons Neck Disposal Area in Long Island Sound. Approximately 150,000 cubic yards of shoal material will be removed. Most of the material will be from the East Branch Channel. Following deposition of the polluted material at the disposal site, a comprehensive monitoring program will evaluate the impacts of the disposal operation on the physical, chemical and biological aspects of the environment.

3. Environmental Impacts. The potential impacts associated with the proposed project are considered with respect to the physical, chemical and biological aspects of the dredge and disposal sites. It is impossible to segregate the three aspects of the environment since they are interrelated. A summary of the major impacts that are likely to result from the implementation of the project at the dredge and disposal sites follows. It must be emphasized that these are potential impacts and no attempt is made here to delineate between short- and long-term impacts.

(1) Alteration of Substrate

(2) Increased Turbidity/Siltation

(3) Release of Toxic Compounds/Nutrients

(4) Degradation of Water Quality

(5) Decrease in Light Penetration

(6) Destruction and Relocation of Benthic Communities

(7) Destruction of Benthic and/or Pelagic Forms from Toxic Compounds

(8) Redistribution of Some Commercial Fishing Patterns Including Lobsters

(9) Concentration of Toxic Compounds in the Food Chain

(10) Interference of Respiration and/or Feeding Due to Siltation

(11) Destruction of Demersal Eggs and Larval Forms

(12) Alteration of Spatial Distribution Patterns of Biota

(13) Alteration of Species Densities

(14) Reduction in Photosynthesis

(15) Alteration of Feeding Habits of Organisms Dependent on Forms Destroyed and/or Redistributed

(16) Improve Safety of Navigation

(17) Reduce Waiting Time for Ships

(18) Promote Continued Utilization of Harbor Facilities

(19) Provide Understanding of Impacts Resulting from Disposal Operations - Ultimately Benefiting Marine Ecosystem

4. Alternatives. Alternatives to the proposed actions relate to dredging and disposal sites. Alternative sites for the procurement of material include Bridgeport Harbor, Norwalk Harbor, Mianus River and Stamford Harbor. Stamford Harbor was selected on the basis of existing conditions within the harbor which require action. Specifically, shoaling within the harbor, especially in the East Branch Channel, has created hazardous navigation conditions for commercial and larger recreational vessels desiring passage. During periods of low water it has become necessary for these larger vessels to wait for deeper water to insure safe passage. The dredging of shoal material is the only means of correcting the problem. A secondary advantage of selecting Stamford Harbor is that it provides material required by the Dredged Material Research Project (DMRP) described in Section 1.0 .

Alternative disposal sites include New London Disposal Site, New Haven Disposal Site, Connecticut River Disposal Site and Eatons Neck Disposal Site. The Eatons Neck Disposal Site was selected because of its close proximity to Stamford Harbor and because it met a set of selection criteria established for the DMRP. The mileage and cost per mile to the other disposal sites do not make it feasible to consider them as realistic possibilities. Land disposal is not considered an alternative because suitable sites are not available in the Stamford area.

1.0 PROJECT DESCRIPTION

1.1 Purpose. The purpose of the proposed dredging of Stamford Harbor, Connecticut is to alleviate existing shoaling conditions in the harbor, specifically the East Branch Channel. Such maintenance dredging is the only means by which hazardous navigation conditions due to shoaling can be corrected. Previous maintenance dredging was conducted in 1964. The proposed action is overdue with respect to the need for corrective measures.

A proposed dredging and disposal project by the U. S. Army Engineer Waterways Experiment Station (WES), Vicksburg, Mississippi designated "Dredged Material Research Program" (DMRP) has been initiated to define the environmental impacts associated with such actions. The program requires the procurement of polluted material with disposal in the aquatic and marine ecosystem. The maintenance dredging of Stamford Harbor coincides with the research project and its primary requirements. The material from Stamford Harbor will be disposed of at a point designated "Site B" at the Eatons Neck Disposal Site. In addition, it is proposed to dispose of relatively "unpolluted" material from East Chester Creek and Milton Harbor, New York at a point designated "Site A" at Eatons Neck.

1.2 Specific Location. Stamford Harbor in Stamford, Connecticut, is located on the north shore of Long Island Sound approximately 36 miles east of New York City. It consists of a bay about 2 miles wide at the mouth

and extending 1.5 miles inland. At the head of the harbor there are two inlets known as the East and West Branches. These inlets extend northward into the City thus forming the inner harbor (Figure 1.).

The total authorized Federal Navigation Project for Stamford Harbor consists of: an entrance channel 18 feet deep, 200 feet wide to the upper end of the 18 foot anchorage, thence 15 feet deep, 125 feet wide in the West Branch with a basin 15 feet deep at the head of the Branch; a channel 12 feet deep, 100 feet wide, with increased width at the turns, up the East Branch to a point 1,100 feet from the head of the navigation; an anchorage area, 18 feet deep on the west side of the 18 foot entrance channel and two breakwaters at the entrance of the harbor, the East Breakwater about 1,200 feet long and the West Breakwater about 2,900 feet long.

The Eatons Neck Disposal Site is located in the western portion of Long Island Sound (Figure 2). Two specific locations have been selected for the dumping of dredged material. Polluted dredged material from Stamford Harbor will be dumped at "Site B" located at latitude 40° 59' 51" N and longitude 73° 27' 18" W as designated by WES as part of the on-going study at the Eatons Neck Site. Less polluted material from East Chester Creek and Milton Harbor, New York will be dumped at "Site A" located at latitude 41° 00' 51" N and longitude 73° 27' 18" W as designated by WES.

1.3 <u>Project Dimensions.</u> The proposed maintenance dredging will entail

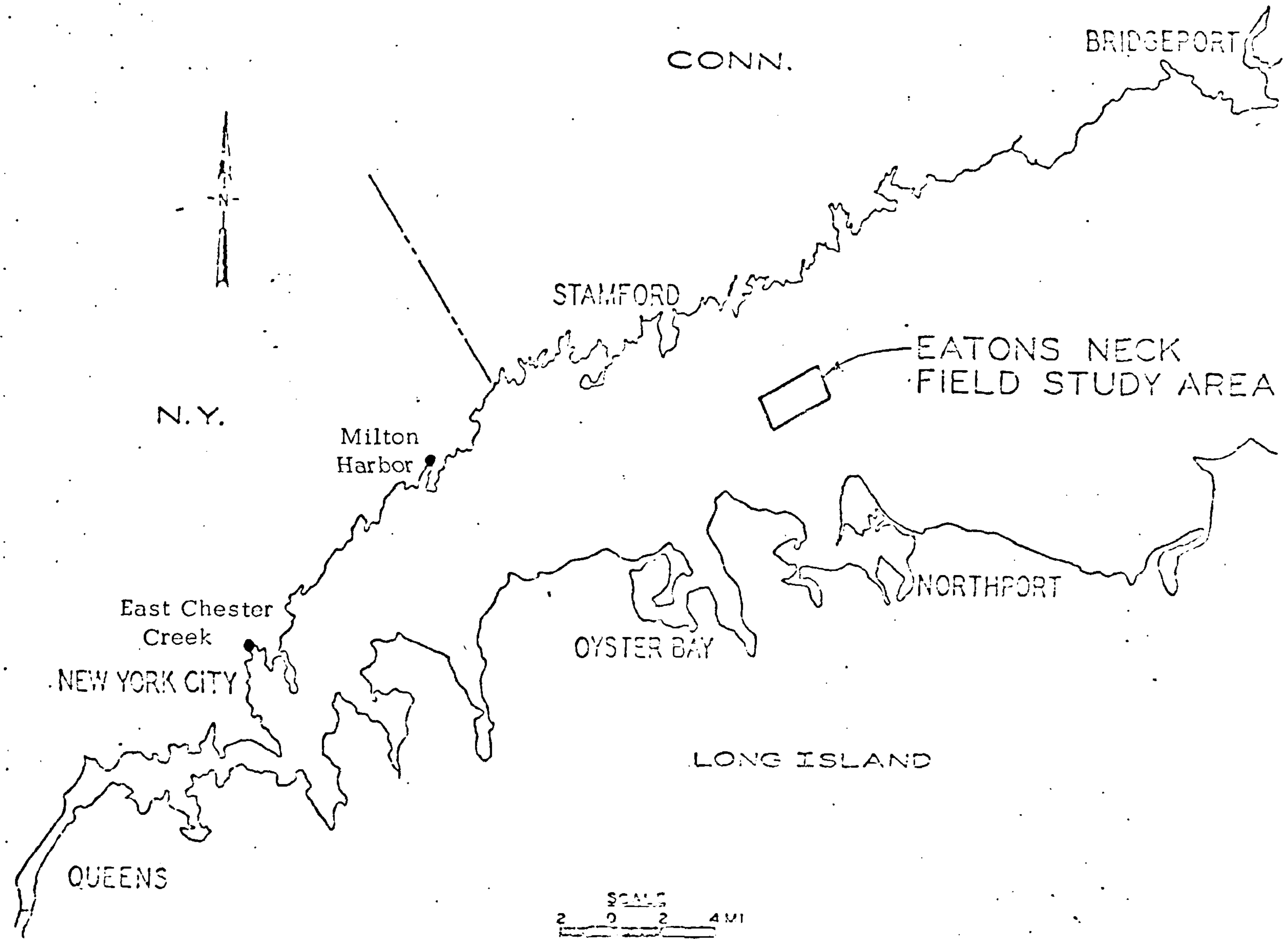


FIGURE 2. MAP OF EATONS NECK DUMP SITE AREA

the removal and disposal of an estimated 150,000 cubic yards of material. Dredging will be accomplished predominantly in the East Branch channel where there is an estimated 130,000 cubic yards. The remainder of the dredging will be to remove the isolated shoals throughout the rest of the project. Excavation of the bottom sediment will be accomplished by a clamshell dredge with the dredged material being barged to the disposal area. The material will be disposed of at Eatons Neck Disposal Area in Long Island Sound. Currently, the polluted material is scheduled to be disposed of during a three (3) month period between Fall, 1975 and Summer, 1976.

The less polluted material from East Chester Creek and Milton Harbor is an estimated 230,000 cubic yards. It is scheduled to be dredged and disposed of during the period 1 October through 30 November, 1975.

Maintenance dredging has been performed over the years as necessary on various portions of the Stamford Harbor project. The East Branch channel was last dredged in 1938, at which time approximately 75,000 cubic yards of material were removed. The latest dredging in the harbor was accomplished in 1964, when 100,000 cubic yards of material were removed from the West Branch channel.

1.4 <u>Authorization</u>. The project was authorized by the following:

Authorizing Acts	Description	Documents
March 2, 1919	East Branch channel and present width of entrance channel	H. Doc. 1130, 63d Cong., 2d Session
August 30, 1935	8-foot anchorage area, present project depth of upper portion of entrance channel, and present project dimensions of West Branch channel and basin	Rivers and Harbors Comm., Doc. 8, 74th Cong., 1st Session
August 26, 1937	Breakwater, 18-foot anchorage basin, and present project depth of outer section of entrance channel	Rivers and Harbors Comm., Doc. 29 75th Cong., 1st Session
July 24, 1946	Substituted 8-foot anchorage basin adjacent to East Branch channel for that in outer harbor	H. Doc., 675, 75th Cong., 2d Session

1.5 Coordination. Coordination of the proposed project and its specific activities has been accomplished throughout the program with Federal, State, and Local agencies. In addition, the project has been coordinated with the specifics of the Fish and Wildlife Coordination Act (Public Law 85-624). (See Section 9 for coordinating agencies).

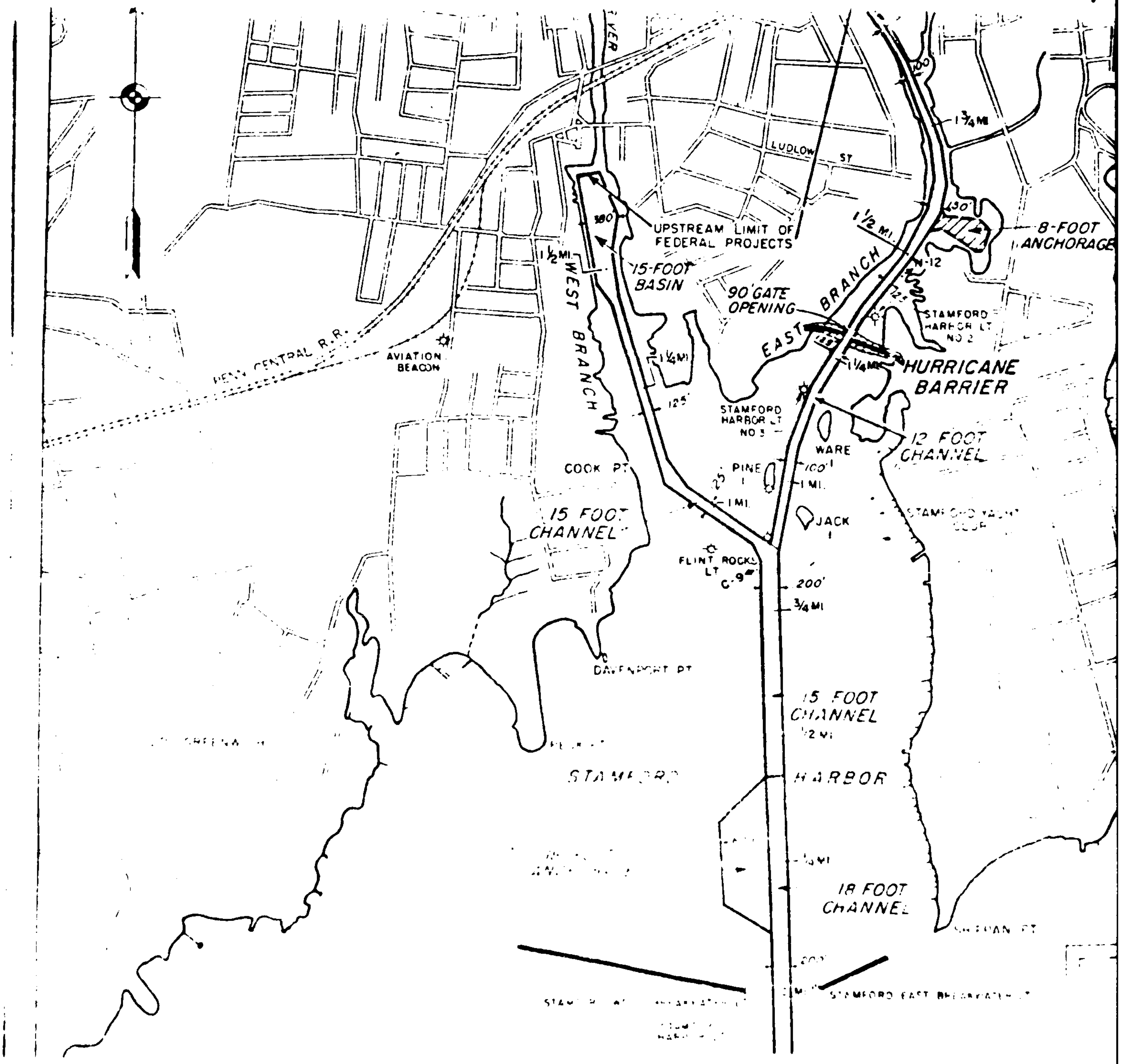
2.0 ENVIRONMENTAL SETTING WITHOUT THE PROJECT

2.1 Area Description - Stamford Harbor. The environmental setting considered here is without the dredging project. As indicated previously,

Stamford Harbor, Stamford, Connecticut, is located approximately 36 miles east of New York City. It is a relatively small, but highly utilized estuarine system on the Connecticut shore of Long Island Sound. It is subdivided into three main areas: the East Branch, the West Branch and the Harbor proper. The East and West Branches combine to form the main harbor region which broadens southward. The southward limit is defined by two breakwaters extending from Shippan Point to Old Greenwich. It is approximately two miles wide at the breakwaters and extends about 1.5 miles inland. Surface area is approximately 746.8 acres (Corps, NED).

The major concern associated with the environmental setting of Stamford Harbor is the industrial or commercial interests along the East Branch which are of significance to the harbor in general. Located south along the east side of the upper East Branch are a sand and gravel plant, the City incinerator, and a chemical company. Located along the west side of the channel are a scrap iron and steel corcern, a bituminous materials plant and an industrial complex (Corps , NED).

Stamford, Connecticut is part of the larger megalopolis system of the northeast. A city of 110,000 people, it is the third largest city on Long Island Sound. It is known as the "commercial center" of western Fairfield County. The economy is based on a variety of sources. It is an important industrial city housing the headquarters of several nationally prominent manufacturers, and is also an important research center for a number of



LUDLOW ST
1¾ MI
UPSTREAM LIMIT OF
FEDERAL PROJECTS
1½ MI
15-FOOT
BASIN
WEST BRANCH
EAST BRANCH
90' GATE
OPENING
8-FOOT
ANCHORAGE
N-12
STAMFORD
HARBOR LT
NO 2
HURRICANE
BARRIER
PENN CENTRAL R.R.
AVIATION
BEACON
1¼ MI
125'
STAMFORD
HARBOR LT
NO 3
12 FOOT
CHANNEL
WARE
PINE
COOK PT
1 MI
JACK
15 FOOT
CHANNEL
FLINT ROCKS
LT
C-9
200'
¾ MI
DAVENPORT PT
15 FOOT
CHANNEL
½ MI
HARBOR
18 FOOT
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STAMFORD EAST BREAKWATER LT

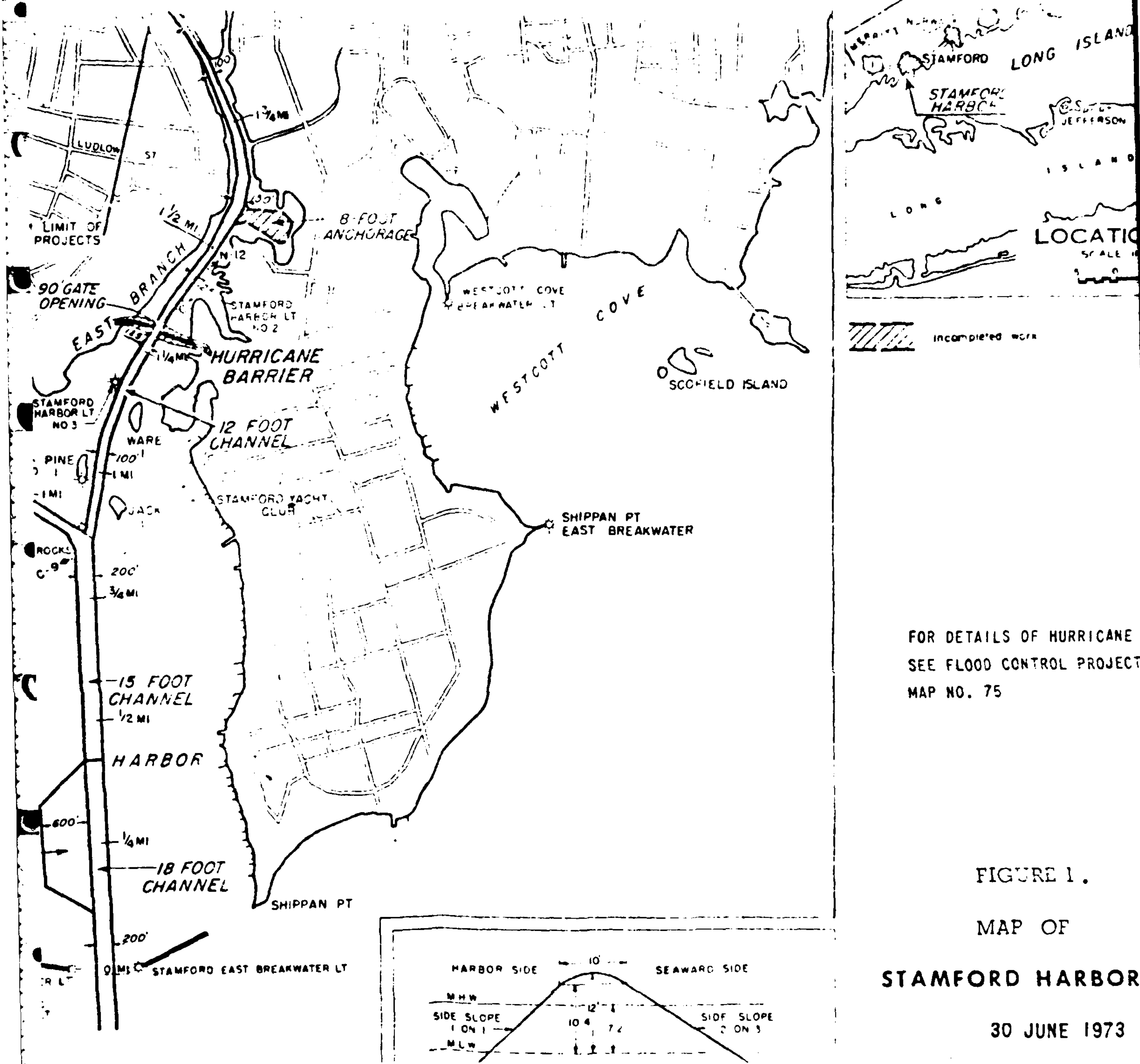

FIGURE 1.

MAP OF

STAMFORD HARBOR,

30 JUNE 1973

large concerns. Recreational boating is also significant to the local economy.

Although Stamford is not one of the largest commercial ports on Long Island Sound, it boasts of being a "boating capital." There are three yacht clubs located within the harbor and three municipal marinas. These are the largest commercial marinas on the Sound. Yachts up to 70 feet in length use the facilities located mainly on the east side of the East Branch (Wilensky, 1971). Pleasure boating is one of the primary uses of the harbor. During 1974 there were 18,300 trips made by vessels having drafts up to 8 feet (Corps, NED). It is also used on a regular basis by commercial vessels. Presently, however, vessels transiting the East Branch are encountering substantial and costly tidal delays as well as hazardous navigational conditions due to shoaling of the channel. The majority of commercial shipping taking place in the harbor is directly related to the needs of the immediate Stamford area. During 1974 commercial usage of Stamford Harbor involved 2,049 trips by vessels having drafts up to 15 feet. These trips accounted for 1,002,384 tons of commerce consisting of petroleum products; sand, gravel and crushed rock; and iron and steel scrap. There are seven terminals located in the harbor system used for unloading oil and other petroleum products (Corps, NED).

Stamford Harbor sediments were collected in 1971 and analyzed qualitatively. According to EPA Criteria (1971b), the sediments were classified

as "polluted". More recent sediment analysis (Corps, NED) conducted in accordance with the latest EPA Criteria (1973) also indicate polluted conditions in Stamford Harbor.

2.2 <u>Area Description - Long Island Sound.</u> Long Island Sound is a semi-enclosed system between Long Island, New York and Connecticut. It is approximately 90 nautical miles long with a maximum width of 15 miles. The Sound was formed by an ancient river system cut in Cretaceous rocks. For the past 5,000 years, the approximate time when the sea reached its present level, waves and tidal currents have been shaping Long Island's shoreline and harbors (WES).

There are eleven bays and harbors along the shoreline of the Sound, ten of which are located in the western and central region. The area is densely inhabited. There are 11 million people living on the shoreline of the Sound. The majority of them commute to New York City to work (Wilensky, 1971).

The major use of Long Island Sound is recreation. There are numerous beaches along the shores of both Long Island and Connecticut where people either live permanently or spend the summer months. The waters of the Sound are used for bathing, boating and sport and commercial fishing. There are 59,000 motor boats registered in Suffolk County, New York alone.

This is the closest county to Eatons Neck. There are also 11 well-organized fisherman associations in the area which have a great deal of influence on the affairs on the Sound (Wilensky, 1971).

While Long Island Sound is heavily utilized for recreation, sport and commercial fishing purposes, it has also been historically used for the disposal of dredged material. There are 17 historic disposal sites on the Sound. They include: Stamford Dumping Grounds, Eatons Neck, Norwalk, Southport, Bridgeport, Smithtown Bay, Port Jefferson, Milford, New Haven, New London, Branford, Falkner Island, Mattituck, Clinton, Cornfield Shoal, North Dumpling and Stonington Dumping Ground. These 17 sites have been reduced to four general regional areas which include: Eatons Neck, Cornfield Shoal, New Haven and New London Disposal Grounds (WES). The Eatons Neck site is located in western Long Island Sound and is subject to environmental stress brought about by Sound usage and runoff from the shoreline.

Chemical data for sediments at the Eatons Neck Disposal Site is not available at this time. However, data is currently being generated by the State University of New York at Stony Brook.

2.3 Water Quality - Physical Environment

2.3.1 Stamford Harbor. The overall ecological conditions of Stamford

Harbor are in part the result of natural forces. More important, however, is the direct influence of man on this system.

Stamford Harbor has an average depth of 10 feet (3 meters) mean low water (mlw). The average depth of the East and West Branches is 7.5 feet (2 m) mlw. The total volume of the harbor at mlw is approximately 1.840 x 10^9 gallons. General physical conditions are similar to those of Long Island Sound. The system experiences semi-diurnal lunar tides having two high and two low tides every 24 hours and 50 minutes. Tidal amplitude is approximately 7.0 feet (ESSA, 1974). The system undergoes seasonal temperature changes typical for the region. The major influencing factor on water temperature is air temperature. Because of the relatively shallow waters, temperature regimes follow seasonal fluctuations. Studies (Riley, 1959) have indicated temperatures range from the mid 30's to the mid 70's F. Again, because of the shallowness of the entire system, there is lettle or no thermal stratification.

Visibility in the harbor is characteristically low. Secchi disc readings indicate the lowest visibility is in the upper portion of the East Branch and West Branch with readings commonly less than 1 meter. Proceeding toward the outer harbor, visibility increases to its maximum outside the breakwaters. Overall average visibility ranges from 1.5 - 2 meters (Conn. DEP). Visibility varies with the time of year. Lowest readings are recorded in May and June with highest readings observed in September and November. These

readings correspond with the time of high and low biological productivity in the system, respectively.

Other parameters of significance include dissolved oxygen and pH. Dissolved oxygen levels vary throughout the year in the harbor. In general the highest values occur during May and June. The lowest readings have been observed during August and September, especially for the inner portion of the harbor. Dissolved oxygen levels have ranged from 0.6 parts per million (ppm) to 16 ppm or more. There has typically been a lack of surface-to-bottom differences in dissolved oxygen concentrations. Oxygen stratification typically does not occur but when it does it is most evident during the month of June. As with visibility readings, dissolved oxygen concentrations are related to biological productivity (Conn. DEP).

Hydrogen ion concentrations (pH) show only slight variations throughout the year. Highest values are recorded during the spring when values of 8.0 - 8.5 have been observed. Lowest values occur during late summer and early fall (7.0 - 8.0). This parameter shows no stratification.

Of major significance to the overall ecology and water quality of the harbor system are a number of features both natural and man-made. The system is subject to a substantial freshwater inflow from the Rippowam River (Fig. 1). It enters the harbor through the West Branch. The major influence

of this inflow is evidenced by fluctuating salinity values particularly in the West Branch. Because of the flushing action of the tidal cycles and the continuous exchange with the waters of the Sound, the influence of the freshwater inflow is limited to the inner portion of the harbor.

There are two remaining features which are of importance to the harbor system. The East Branch receives substantial quantities of inadequately treated municipal waste from the City of Stamford. The treatment facility located along the East Branch receives sewage from the City of Darien as well. The entrance of large quantities of domestic and industrial waste material into Stamford Harbor has placed extreme ecological stress on the entire system. The treatment plant has been completely over-extended. Currently, the plant has an average daily discharge of 10,000,000 gallons into the East Branch. The quality of the effluent is as follows: 5-day BOD is 4,920.5 kg/day on a monthly average; suspended solids are 3,028.0 kg/day on a monthly average. After July 31, 1975 the plant will discharge an average of 20,000,000 gallons per day with a 5-day BOD of 2,271.0 kg/day on a monthly average; suspended solids will be reduced as well (Conn. DEP).

The EPA (1971a) and the Connecticut DEP have indicated that aggregate waste material being discharged by the City of Stamford into the East Branch contributes significantly to the state of pollution evident in

Stamford Harbor. This situation, however, is further complicated by the additional discharge of industrial waste material directly into the harbor waters. It is not known how long raw waste material has been discharged directly, but overall conditions have been undergoing steady degradation for a considerable period of time. This material has affected both water quality and the biological community. By-products are discharged from the following industries as well as others not listed: photo-engraving, electroplating, photographic paper production and chemical manufacturing.

Stamford Harbor has been classified as SC waters under the Connecticut State Water Quality Standards (Conn. DEP, 1974). The use and criteria associated with these standards follow:

STANDARDS - CLASS SC

Suitable for fish, shellfish and wildlife habitat; suitable for recreational boating and industrial cooling, good aesthetic value.

1. Dissolved oxygen	Not less than 5 mg/l for more than 6 hours during any 24-hour period and at no time less than 4 mg/l. For cold water fishery, SC, not less than 5 mg/l at any time. SC_s-6 mg/l.
2. Sludge deposits - solid refuse - floating solids, oils and grease - scum	None except for small amounts that may result from the discharge from a waste treatment facility providing appropriate treatment.

3. Sand and silt deposits	None other than of natural origin except as may result from normal agricultural, road maintenance, or construction activity provided all reasonable controls are used.
4. Color and turbidity	None in such concentrations that would impair any usages specifically assigned to this class.
5. Coliform bacteria per 100 ml	Not to exceed an average in any 30-day period of 5000 nor exceed this value in more than 20% of the samples collected during the period.
6. Taste and odor	None in such concentrations that would impair any usages specifically assigned to this class and none that would cause taste and odor in edible fish or shellfish.
7. pH	6.5 - 8.5
8. Allowable temperature increase	None except where the increase will not exceed the recommended limit on the most sensitive receiving water use and in no case exceed 83°F or in any case raise the normal temperature of the receiving water more than 4°F. During the period including July, August and September, the normal temperature of the receiving water shall not be raised more than 1.5° unless it can be shown that spawning and growth of indigenous organisms will not be significantly affected.
9. Chemical constituents	None in concentrations or combinations which would be harmful to human, animal or aquatic life or which would make the waters unsafe or unsuitable for fish or shellfish or their propagation, or impair the water for any other usage assigned to this class.

The discharge of industrial and municipal waste into the waters of Stamford Harbor has resulted in a degradation of water quality. The system is polluted according to Connecticut State Standards. This is clearly indicated by the coliform bacteria levels. According to the Standards, total coliform levels should not exceed 5,000/100 ml of sample. Coliform levels as high as 32,000/100 ml have been recorded in the harbor (Conn. DEP). High coliform bacteria levels indicate the liklihood of human facal contamination and represents the potential for disease-causing pathogens. In addition to coliform bacteria, heavy metals and oil and grease have been found to exceed the Standards within the harbor.

The National Shellfish Sanitation Program, HEW, U. S. Public Health Service, (1965) has established certain criteria for growing shellfish for human consumption. According to these criteria, Stamford Harbor is grossly polluted with respect to the shellfish industry. The criteria for growing shellfish destined for human consumption follow :

(a) The area is not so contaminated with fecal material that consumption of the shellfish might be hazardous, and

(b) The area is not so contaminated with radionuclides or industrial wastes that consumption of the shellfish might be hazardous and

(c) The coliform median MPN of the water does not exceed 70 per 100 ml., and not more than 10 percent of the samples ordinarily exceed an MPN of 230 per 100 ml. for a 5-tube decimal dilution test (or 330 per 100 ml., where the 3-tube decimal dilution test is used) in those portions of the area most probably exposed to fecal contamination during the most unfavorable hydrographic and pollution conditions. (Note: This concentration might be exceeded if less than 8 million cubic feet of a coliform-free dilution water are available for each population equivalent (coliform) of sewage reaching the area). The foregoing limits need not be applied if it can be shown by detailed study that the coliforms are not of direct fecal origin and do not indicate a public health hazard.

The extreme ecological stress in the harbor has been progressing for some time. It is obvious, however, that man's activities have contributed substantially to the existing conditions.

2.3.2 Long Island Sound. The ecology and water quality of Long Island Sound, like Stamford Harbor, are related to a variety of natural and man-made forces. The large number of people living along its shores in addition to the free exchange between the Sound and harbor waters are of significance to overall conditions.

Long Island Sound experiences the same semi-diurnal tidal cycle as Stamford Harbor. Tidal amplitude ranges from a maximum of 2.5 feet (0.76m) in the area of the Race at the eastern end to 7.3 feet (2.2m) at the western end (ESSA, 1974). The average depth of the Sound is 65 feet (20 m). The greatest depths (325 feet; 100 m) are found at the eastern end. There is little water greater than 113 feet (35 m) in the central or western portions of the Sound. Depths at Eatons Neck Disposal Site range from 69 - 130 feet (21 - 40 m) mlw (Riley, 1956).

There are a series of currents and overall movements of water masses established in the Sound. Specifically, circulation is controlled primarily by river discharges and tides. The drainage basis for the Sound is approximately eleven times the area of the entire system and contributes about 35% of the volume of the Sound. However, 75% of the runoff discharged into the eastern portion by the Connecticut and Thames Rivers has little effect on the hydrology of the system.

There are three major patterns of circulation or circulating eddies which have been identified. These are 1) counterclockwise circulation in the western region, 2) counterclockwise in the eastern region, 3) clockwise in the central region. The general direction of flow of surface waters is eastward out of the Sound into Block Island Sound then south-southeastward. Here, the waters of the two systems mix thoroughly with open coastal

waters. A limited amount of water enters the Long Island Sound from the western end. A bottom westward movement of water has been identified from Block Island Sound into Long Island Sound (Gordon and Pilbeam, 1975; Paskausky, et al., 1975).

General water quality parameters including temperature, pH, dissolved oxygen and visibility exhibit ranges typical for the region. Temperature readings range from approximately 3°C to 19°C in the eastern end of the Sound. Temperatures in the central and western regions range from 0°C to 23°C (Serafy, 1974, Riley, 1959). Salinity readings exhibit a typical marine environment ranging from 23-31°/oo (Riley, 1956; Bohlen & Tramontano, 1974). This is an average range and does not reflect the influence of inflowing freshwater rivers. In areas where rivers discharge into the Sound, salinity values drop considerably. The extent of freshwater wedges is dependent upon tidal stages and currents.

Long Island Sound is classified as a moderately turbid body of water. Riley and Schurr (1959) report Secchi disc values ranging from 1-5 meters. Visibility is dependent upon a number of factors including runoff, inflow of streams, currents and time of year. Riley (1956) reports visibility as low as 0.2 meters during heavy algae blooms. Other factors responsible for decreased visibility include dissolved and particulate organic matter,

and silt and bottom sediments in suspension. Visibility in Long Island Sound is lowest during May and June, the period of greatest biological productivity in the form of algae blooms. Highest values are typically recorded during the months of September,October and November. Specific location and local factors are of major significance in determining visibility. Visibility in the eastern end of the Sound is greater than that in the central and western regions. A free exchange of water at the eastern end with less turbid water of Block Island Sound is responsible. Flushing action is less effective proceeding westward where suspended material is somewhat greater. Water quality data on Long Island Sound and specifically the Eatons Neck Disposal Site are being generated.

2.4 Dredged Material Disposal - Eatons Neck. The history of the Eatons Neck Disposal Site covers approximately 20 years. It has been an active disposal site for this period of time with a total of 13,960,826 cubic yards of dredged material being disposed of in the area (WES). It is significant however, that Eatons Neck has not been utilized as a disposal area since March, 1973 (WES). This is largely due to restrictions enforced by the EPA and various state agencies.

2.5 Aquatic Life

2.5.1 Stamford Harbor. Despite the extreme stress placed on the ecology of Stamford Harbor by the discharge of industrial and municipal

waste material, the system exhibits a significant biological community structure. Studies have indicated that biological organisms respond readily to the discharge of polluted effluent (Tarzwell and Gaufin, 1953).

Various representative organisms in Stamford Harbor have been described in a recent study (Northeast Utilities Service Company (NUSC), unpublished data). Net primary productivity in Stamford Harbor is lowest during the winter and early spring months. It increases, however, during late spring and early summer reaching a peak in May and June. After the June peak, it begins to decline to a low again during the late fall and winter.

Nutrient build-up in the harbor is directly related to the discharge of municipal waste. Although nutrient levels are high throughout the year, utilization by phytoplankton is limited by low temperatures during the fall and winter months. Primary productivity in the East Branch is lower than might be expected due to the extreme state of ecological stress in that region. The decomposition of organic waste material is high.

Chlorophyll a concentrations in Stamford Harbor reflect phytoplankton density. Peak chlorophyll a levels are recorded during the late spring and early summer. Lowest levels occur in the late fall and winter (NUSC). These levels correspond to dissolved oxygen concentrations showing the same periodicities.

Phytoplankton populations show the greatest numbers of distinct taxa in May throughout the harbor. Conover (1956) and Riley and Conover (1967) report the most abundant group present were the diatoms (Chrysophyta), representing 90% of the total net phytoplankton. Other major groups represented include the greens (Chlorophyta), the blue-greens (Cyanophyta), and the dinoflagellates (Pyrrophyta). Common diatoms present in the harbor include Coscinodiscus spp., Chaetoceros spp., Nitzschia seriata, Skeletonema costatum, and Melosira spp.

Zooplankton populations exhibited high density but low species diversity throughout the harbor. Adult copepods as well as various immature stages including nauplii are the most abundant group represented. The most common species is Acartia clausi. Deevey (1956) described the zooplankton of Long Island Sound indicating a greater species diversity in both the Sound and Stamford Harbor than more recent studies have indicated. She also reported Acartia clausi the dominant copepod throughout the study area during the summer months. Zooplankton blooms correspond approximately with phytoplankton density peaks in the area. Other plankton forms of major significance in Stamford Harbor include larval stages of Modiolus demissus, Mya arenaria, and polychaetes, other molluscs and cladocerans (NUSC).

Stamford Harbor is also productive with respect to benthic species. In the general harbor area over 100 benthic taxa have been recorded by

Richards and Riley (1967) and Sanders (1956). Dominant benthic species are polychaetes represented by the families Cirratulidae, Glyceridae, Spionidae, Sabellanidae, Paranoidae, Syllidae, Pectinaridae and Polynoidae. Other abundant benthic forms include immature mysids, amphipods, and decapod crustaceans. Mya arenaria and Ensis directus are also abundant in the harbor. Epibenthic invertebrates in the harbor include sponges (Cliona celata and Desmacidon palmata), cnidaria hydroids (Metridium sp., Obelia sp., and Tubularia sp.), gastropods (Urosalpinx cinerea and Crepidula fornicata), ectoprocts, starfish and various forms of crustaceans (NUSC).

Various types of intertidal forms are common throughout the harbor depending upon available substrate. Macroscopic algae (Ulva, Fucus vesiculosus) and barnacles (Balanus balanoides) are common on rocks and the breakwaters. Common in sandy areas are annelids, molluscs and the shipworm, Teredo navalis (NUSC).

Stamford Harbor once had productive oyster beds which produced oysters on a commercial basis for human consumption. Due to extreme pollution within the harbor, however, these beds have been closed to harvesting for a number of years. At the present time, there are active soft-shelled clam beds. Mya arenaria is grown within the area of the outer harbor below the junction of the East and West Branches south to the breakwaters. Clams are removed from the beds and purified elsewhere for human

consumption. Commercial lobstering is also common in the outer harbor but the magnitude of this fishery is not known at the present time (Personal communication with local fisherman).

Stamford Harbor is also important with respect to finfish. Sport and commercial fishing within the harbor is conducted regularly. The most abundant species present are winter flounder (Pseudopleuronectes americanus), cunner (Tautogolabrus adspersus), silversides (Menidia sp.), and mummichogs (Fundulus heteroclitus and F. majalis). Other less abundant species include windowpane flounder (Scopthalmus aquosus) and tomcod (Microgadus tomcod). Winter and windowpane flounder are the most important sport fishery in the Harbor and are present throughout the year (Richards, 1963). Bigelow and Schroeder (1953) report that mummichogs are eurythermal and euryhaline. They also report silversides and cunner as being relatively eurythermal but indicate the cunner is vulnerable to extremely low temperatures.

Several species of migratory fish are commonly reported from Stamford Harbor. These include blueback herring (Alosa aestivalis), Atlantic menhaden (Brevoortia tyrannus), rainbow smelt (Osmerus mordax), porgy (Stenotomus chrysops), bluefish (Pomatotomus saltatrix), and alewife (Alosa pseudoharengus) (NUSC).

Stamford Harbor is also utilized as a nursery by many fish species. Juvenile forms of blueback herring and menhaden appear in the harbor during the late summer and early fall. Young porgies are observed and taken from August through October from immediately outside the breakwater. Juvenile rainbow smelt appear in the harbor from April through July and August (NUSC). Larvae of blueback herring, alewife, Atlantic menhaden, and others are also common in the harbor (Richards, 1963; Merriman and Warfel, 1948). The harbor area contributes to a commercial fishery.

In general, species diversity is greater in the harbor below the junction of the East and West Branches and increases toward the south. Species diversity in the East and West Branch is extremely low due to the polluted conditions.

2.5.2 Long Island Sound - Eatons Neck Disposal Site. The biology of Long Island Sound has been examined and described in several reports (Richards, 1963; Conover, 1956; Deevey, 1956). A complete description and inventory of the Eatons Neck Disposal Site, however, requires additional work. This is being done under the current DMRP program.

The studies conducted to date indicate a general increase in phytoplankton density proceeding toward the western end of the Sound. This increase is reflected in higher chlorophyll *a* concentrations in that region.

Chlorophyll a and net primary productivity both show the same seasonal trends observed and recorded for Stamford Harbor. Highest productivity occurs during the late spring and early summer with a decline into the winter when it is lowest. Chlorophyll a concentrations tend to be greater in the upper portion of the water column.

The phytoplankton of Long Island Sound has been reported by Conover (1956) and Riley and Conover (1967). They list the Chrysophyta as being the most dominant group present. Phytoplankton species common at Eatons Neck as well as western Long Island Sound include: Thallassiononа nitzschioides, Skeletonema costatum, Chrysochromulina sp., and Nelosira sulcata.

A preliminary report by New York Ocean Science Laboratory (1975) indicates that benthic populations at Eatons Neck are divided into groups according to the types of sediments they prefer. These include silty gravel and sand, sandy mud and mud. The sandy mud and mud areas have similar biological communities.

The sandy-gravelly areas at Eatons Neck are dominated by the archiannelid Polygordius triestinus. Other benthic forms present in significant numbers at the sandy areas include the bivalve, Tellina agilis, polychaetes (Aricidea jeffreysii, Mediomastus ambiseta), tube-dwelling amphipods

Ampelisca vadorum) and slipper shells (Crepidula fornicata).

Recent examinations at Eatons Neck indicate that the greatest species diversity occurs when sand and gravel is the substrate and the lowest diversity is found on mud substrate. Species in abundance at muddy locations include Mediomastus ambiseta, Mulinia lateralis, Nephytys incisa, and Nuclula proxima. Mulina sp. is a bivalve which is short-lived but which exhibits a high rate of growth and reproduction. It is common in unstable and changing bottom sediments. The presence of this species indicates the nature of the substrate at Eatons Neck. Also dominant in the mud and sand regions are nematodes, copepods and ostracods (New York Ocean Science Laboratory, 1975).

Long Island Sound and specifically the area of the proposed disposal site is significant with respect to sport and commercial fishing. Lobster fishing is also conducted on a commercial basis in the area. Numerous permanent and migratory fish species are common throughout the Sound and are the same as those reported in Stamford Harbor (New York Ocean Science Laboratory, 1975).

Zooplankton populations compare with those recorded by Deevey (1956). Of significance at Eatons Neck is the dominance in the fall by ctenophores. Density has been reported so high as to interfere with the qualitative and quantitative evaluations of other zooplankton populations. The density

of ctenophores decreases in November and December.

The zooplankton community at the disposal site exhibits a similar trend as that in Stamford Harbor. Species composition differs. The dominant species at the dump site is Acartia tonsa. This species shows high density during the late fall and early winter. Data is lacking on the remainder of the year. Other copepods present include Pseudodiaptomus coranatus, Labidocera aestiva and Acartia clausii. Juvenile copepods are present at the dump site during late fall and early winter and are as abundant as adult forms (New York Ocean Science Lab., 1975).

2.6 Geology. The geology of the Eatons Neck Disposal Site is stated briefly. As discussed earlier, the Sound presently occupies an area previously formed by an ancient river system. Glacial action changed the local geology and eventually the river valley was covered by the sea.

The sediments at the dump site are composed of sand, gravel, silt and mud. There are also clay deposits present. Layers of find-grained silts are common throughout the region. There are also large blankets of carbon-rich, gelatinous mud covering much of the silt. The thickness of the mud layer varies with location. There are also large areas of coarse-grained sand and gravel deposits. These are especially common where currents or other forces have either prevented or eroded the layer

of gelatinous mud. There is some variation with respect to sediment composition with the depth of the water. In general, sand is the most common type of substrate in waters less than 32.5 feet (10 m). A stratified blanket of sediments is present under the existing upper layers which ranges from approximately 65 to 270 feet (20 - 84 m) (WES undated; Serafy, 1974).

The composition of sediments in Stamford Harbor is largely silt and mud. Some coarse-grained material is also present. Additional information on sediment structure is needed (Conn. DEP).

2.7 <u>Relevance of the Harbor to Economics and Recreation of the Region</u>. The use of the harbor has been discussed in detail above. It is evident from that discussion that the harbor serves as a multi-purpose system. Of major significance to the economy and recreation of the overall region are the large yacht clubs and marinas. These facilities are utilized heavily and add significantly to the general economy of the area. The recreational boating industry is not limited to the summer months. These facilities provide storage and maintenance services which are also economically profitable. In addition to recreational boating, commercial boating in the form of vessels carrying commerce is also carried out on a regular basis in the harbor.

The above commercial and recreational activities are of economic

importance to the general area. It is difficult to evaluate the entire impact of these two activities but it is probable that should they cease the impact to the economy would be significant both in terms of dollars lost as well as jobs.

3.0 RELATIONSHIP OF PROPOSED ACTION TO LAND USE PLANS

The relationship of the proposed action to land use plans falls into two categories. First is the relationship between the project and the present and projected use of Stamford Harbor. Second is the relationship between the proposed project and the DMRP, specifically from the standpoint of disposal.

As described previously, the activities of both commercial and recreational boating in the harbor syst is of major significance to the economy of the general area. It is not known at this time if plans exist for the expansion of any form of boating. If the present level of economic support resulting from boating is to be maintained or increased, it is advantageous to maintain the harbor channels to ensure safe passage of boats and barges.

Land use plans as they pertain to the shoreline around the harbor would only be influenced by the proposed project if they included an increase in the number of wharves and/or marinas. If such expansion was

undertaken, it again would be advantageous to maintain the channels within the harbor to insure safe passage. The present shoaling of the inner harbor including the East Branch represents a threat to safety and is costly in terms of larger vessels waiting for deeper water to avoid running aground.

The selection of land for disposal of dredged material is the responsibility of local agencies. Federal law requires that sites be located for land disposal by such agencies. In the case of the Stamford Harbor project, local individuals are unable to provide an adequate site for land disposal. In view of this situation, WES has decided to dispose the material in the water.

4.0 THE PROBABLE IMPACT OF THE PROPOSED ACTION ON THE ENVIRONMENT

Environmental impacts that will occur from the implementation of the proposed project can be differentiated into those caused by dredging operations and those caused by disposal operations. Impact will result to the physical, chemical and biological aspects of both the dredge and disposal sites. In addition, consideration should be given to the impacts on aesthetics and socio-economic factors. The degree to which impact occurs in any of the above areas is dependent upon a number of factors which include, but are not necessarily limited to, the following: location and magnitude of the

operation, duration, season of the year, diversity of biota present, currents, utilization of the area as a nursery, overall community structure, techniques used and chemical nature of the sediments. Table 1 is a summary of the physical-chemical and biological impacts that are likely to result from the proposed operation at the dredge and disposal sites.

4.1 Dredging Operation

4.1.1 Physical. There are several clear-cut impacts that will result to the physical aspects of the environment as a result of the dredging operation. The most obvious will be the removal and alteration of the substrate utilized by various marine and estuarine forms. The minimum area affected will be the physical path of the dredging identified by the channel. In terms of the overall harbor, this amounts to approximately 7 percent of the entire harbor floor including the East Branch. The greatest effects will occur in areas where the substrate represents optimum conditions for the habitation of biota. At the present time, it is not clear where or if these optimum conditions exist within the harbor. It is clear, however, that the physical dredging process and subsequent destruction of benthic communities will be least in the areas of severe water quality degradation, specifically in the East Branch. Since species diversity and density increases toward the outer harbor and the Sound, the dredging operation in this area is expected to have a greater adverse impact.

TABLE 1. SUMMARY OF POTENTIAL IMPACTS

Phase of Project	Physical/Chemical Impacts	Biological Impacts	Other Impacts
Dredging Operations	. Removal of Benthic Substrate . Increased Turbidity - Siltation . Reduction of Light Penetration . Release of Potentially Toxic Substances . Release of Nutrients . Degradation of Water Quality	. Destruction of Benthic Communities in Dredge Corridor . Covering of Adjacent Benthic Communities from Settling Turbidity Cloud . Interference with Respiration and/or Feeding from Siltation . Destruction/Alteration of Eggs and Larval Forms in Project Area . Potential Concentration of Toxic Substances in Food Chain . Potential Lethal Effects of Toxic Substances . Localized Algal "Blooms" . Local Reduction of Species Densities	. Redistribution of Fishing Patterns - Including Lobstering . Improves Safety of Navigation . Reduces Waiting Time for Deep-Draft Vessels . Promotes Continued Utilization of Harbor Facilities with its Economic Implications

TABLE 1. (Continued): SUMMARY OF POTENTIAL IMPACTS

Phase Of Project	Physical/Chemical Impacts	Biological Impacts	Other Impacts
Disposal Operations	. Increased Turbidity . Siltation . Reduction of Light Penetration . Addition of Material to Benthic Substrate . Introduction of Potentially Toxic Substances/Nutrients . Degradation of Water Quality	. Covering and Destruction of Benthic Communities . Interference with Respiration and/or Feeding From Siltation . Covering of Demersal Eggs and Larvae . Potential Concentration of Toxic Substances in Food Chain . Alteration of Spatial Distribution of Biota	. Redistribution of Fishing Patterns Including Lobstering . Provides Understanding of Impacts Resulting from Disposal Operations Ultimately Benefiting the Marine Ecosystem

In addition to the physical alteration resulting from dredging, another significant effect will be increased turbidity. The operation will result in increased amounts of suspended matter in the water, measured as turbidity. It is next to impossible to predict the exact levels of turbidity that will result or how such levels will ultimately compare with natural or ambient turbidity levels throughout the system. Also, it is difficult at this time to determine with any degree of precision how far the turbidity plume will extend out from the actual dredging site. Wind and current patterns as well as the tidal cycle will all be significant in determining the extent to which the suspended matter and high turbidity levels will travel.

4.1.2 Chemical - Water Quality. The dredging operation in the harbor will produce impacts to general water quality. The major source of impact will be the potential release of various chemical constituents in varying, unknown, quantities. Such compounds and elements will then be subject to transport throughout the harbor or into the Sound depending on tide, winds and currents during the dredging process.

Marine chemistry is complex at best. Examination of the sediments indicates pollution according the the EPA Criteria. The release of heavy metals, coliform bacteria, various toxic compounds and nutrients in the immediate dredge area at any given time is likely to result in at least a temporary decline in water quality in that area. It is important to realize,

however, that the present water quality within the harbor is already considered polluted. Water quality conditions in the East Branch will likely suffer little from any release of toxic compounds or heavy metals. The potential impacts to water quality resulting from the release of sediment constituents increases with distance from the East Branch where overall quality may be somewhat better. Additional monitoring is essential to better understand how the release of sediment constituents affect existing water quality in an area.

4.1.3 Biological. The most obvious effect on the biological communities in Stamford Harbor which will result from the proposed project will be their physical destruction. As habitat is destroyed, organisms will also be destroyed or redistributed. Attached forms are likely to experience the most damage whereas motile species may escape. Actual destruction or organisms is expected to be limited to the immediate dredged area in the channel where substrate is removed. In addition, the immediate fringes of the dredged site may also experience destruction. Again, the greatest impact will be realized by infaunal and epifaunal organisms in the immediate area.

Increased levels of turbidity that will result from the operations, as discussed above, will have varying impacts on the biota of the harbor. The most drastic impact would be expected to result from the settling out

of suspended matter (siltation). This impact will be proportional to the species diversity and overall productivity where settling occurs. Obviously, in areas where siltation is greatest and benthic communities are completely buried, impact will be greatest. It is felt, however, that the plume of greatest suspended material will not travel great distances from the actual area of the operation and that resulting siltation will greatly decrease away from the dredge.

The dredging operation will impact phytoplankton populations in two basic areas. The physical operation may release nutrients as well as toxic compounds from the sediments. Increased nutrient levels could be sufficient to produce "blooms" in areas where concentrations are high. Wind and currents as well as tides may concentrate nutrients in coves or certain areas of the harbor. It is likely, though, that released nutrients will be diluted by the current action and that "blooms" will be limited with respect to both duration and area. Phytoplankton may also experience impacts in the form of death if toxic compounds are released in sufficient quantities and remain concentrated in one area. Again, this situation is likely to be minimized by dilution and is not expected to be a major problem.

Increased turbidity may also impact phytoplankton populations in lowering the depth of light penetration in the water. The result would be

reduced photosynthesis with depth. Again, however, it is expected that such conditions will be limited to the immediate dredged area and are not likely to be a problem.

In areas where sediment constituents are released to biologically productive communities, impacts from toxicity may result. Toxicity represents a potential impact to any biota in areas where concentrations are not reduced by dilution. In the event that such an impact does occur, it is expected to be in limited areas only. The greatest potential for such an impact would be in the East Branch where dilution may be slower. However, populations of biota in that area are presently low due to existing high pollution loads.

4.1.4 Aesthetics. The proposed dredging in Stamford Harbor is not expected to produce any major impacts to the aesthetics of the area. If increased turbidity is considered an impact on aesthetics it will be of short duration. It is also possible that hydrogen sulfide which is typically recognized as smelling like rotten eggs, may be released into the air. Again, such a situation will be short-lived.

4.2 Disposal Operations

4.2.1. Physical. As with the dredging operations, the disposal of dredged material will produce several clear-cut impacts at Eatons Neck Disposal Site. The most obvious physical impacts resulting from the dumping of dredged material will be sediment deposition. The depth to which the

material will accumulate over the dumping area is not possible to predict at this time. The major implication of such action is directly associated with the biological communities present and will be discussed below.

A second obvious impact resulting from the dumping operation will be a rise in turbidity in the immediate area. The more dense material is expected to settle to the bottom rapidly, but the lighter silt may remain suspended in the water column for a considerable period of time (Gordon and Pilbeam, 1975). The most important factor in controlling the degree of impact of high turbidity and suspended solids will be the wind, tidal stage and current action and the speed at which the turbidity cloud is diluted.

4.2.2 Chemical - Water Quality. It is difficult at best to predict the impact of disposing dredged material on overall water quality in a given area. Complex chemistry is involved which requires full understanding if impacts are to be fully identified. The potential exists, however, for a degradation of water quality at Eatons Neck Disposal Site resulting from the disposal of polluted material from Stamford Harbor. Furthermore, the release of such material at the Eatons Neck Site could result in both short and long term impacts which may not be identified for some time in the future.

4.2.3 Biological. The dumping of dredged material at Eatons Neck will produce impacts on the biological communities which are physical and chemical

in origin. The most obvious impact will be the sediment deposition. This physical process will result in the destruction of various biological communities present. In such cases, death may result from the physical forces or from burial and resulting suffocation. Benthic invertebrates that are able to burrow may migrate vertically to the surface without significant damage or death. It is reasonable, however, to assume that a percentage of the benthic forms representing various groups, will be destroyed by the disposal operating. These may include lobsters and bottom fish such as flounder as well as some invertebrates. The physical destruction of pelagic forms including plankton and fish by the disposal operations is less likely to occur. These forms can either move out of an area of distress or are carried fast enough by currents that their brief stay in such an area is not fatal.

The physical aspects of the disposal operation, siltation and high turbidity, may interfere with the respiration of both pelagic and benthic forms present. As discussed above, attached benthic forms may suffocate. Respiratory damage may also occur among the motile forms. It is generally accepted that fish can withstand high concentrations of suspended sediments for short periods of time without great danger. The major impact of turbidity and suspended sediments at the disposal site will depend on the movements of the water. If disposal is done on a calm day with very slow

water movement, organisms even of the pelagic form may be impacted from the material remaining in a localized area.

High concentrations of suspended material at the disposal site may also reduce light penetration sufficiently to result in a drop in the photosynthetic rate of phytoplankton. Again, currents are expected to transport suspended material away from the immediate disposal site with dilution occurring rapidly enough so as to minimize the potential for such an impact.

In addition to the physical aspect of the disposal operation there is the potential for severe impact due to toxic compounds. Again, it is difficult if not impossible at the present time, to evaluate the full extent of such impacts. The release of toxic compounds represents a potential for death or severe damage to biota in the disposal site area.

4.3 Socio-Economic. The dredging of the channels in Stamford Harbor will have several beneficial impacts. Such actions will ensure continued use of the system both on a commercial and recreational basis. Furthermore, the economics of maintaining the harbor safe for passage of vessels at any stage of the tide is of major significance. Figures are not available, but it is certain that the costs of waiting for the flood tide and sufficient water depth would be reduced by the proposed project. It is possible that by failing to dredge the channels an eventual situation could arise which would

result in large numbers of Stamford's recreational yachts finding other, safer, areas. An end result could be a detriment to the economy of Stamford, specifically the waterfront.

4.4 Contribution to DMRP. The implementation of the proposed dredging project will provide long-term beneficial effects with respect to the DMRP. The primary aim of the project, as stated above, is to identify the environmental consequences of dredging and disposal as they relate to the physical, chemical and biological resources of the marine environment. If the project is not carried out the opportunity to study the environmental impacts of disposing polluted sediments would be lost. Beneficial impacts will be the understanding resulting from the project of the complex relationships associated with dredge-disposal operations.

5.0 PROBABLE ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED

The adverse environmental impacts that are likely to occur with the implementation of the proposed project can be characterized as short- and long-term. Since the major concern is how the project will ultimately affect the resources important to man at either the dredged or disposal site, impacts to water quality and the biological community are considered in more detail here.

5.1 Water Quality. Water quality is of major significance in determining the existence of biological communities in a given area. The impacts that

are likely to result on water quality from the proposed dredging operation can be considered short-term. The major impact to water quality in the harbor will result from the potential release of entrapped pollutants in the sediments. Again, it is difficult to fully assess the impacts of such material on overall water quality. It is expected, however, that the flushing action of the harbor will dilute chemical constituents released from the sediments and that any degradation will be short-term. Furthermore, such degradation is not expected to be uniform throughout the harbor system.

The impact to water quality from the dredging action is expected to be less in the East Branch. This is due largely to existing poor water quality. Even the release of heavy metals, oil and grease or coliform bacteria from the sediments will do little to make the already poor conditions worse. Again, such impacts in the East Branch are to be considered short-term.

The major impact to overall water quality is likely to occur at the disposal site. Here, water quality may undergo degradation as a result of the release of polluted dredged material. The impact would be associated with heavy metals, oil and grease, coliform bacteria as well as pathogens and various other pollutants. Local conditions at the disposal site will determine the extent of such degradation and how far the impact is realized from the actual disposal site. The impact in the surface waters is expected to be

short-term. It is possible, however, that these impacts may be of considerably longer duration in the deeper water, especially near the bottom.

Another potential impact on water quality is associated with increased turbidity resulting from dredging and disposal. Suspended matter, characterized as turbidity, has been recognized as a factor declining water quality (Corps,NED). High turbidity levels may ultimately impact biological communities either directly by interferring with feeding or respiration or indirectly by reducing the rates of photosynthesis and thus dissolved oxygen concentrations. The level of turbidity and its duration either at the dredged site or the disposal site is a major factor with respect to level of impact. Studies by Bokuniewicz, et al., (1974), in Long Island Sound on turbidity following dumping, however, are significant. It was found that the turbidity "cloud" settled rapidly and that 26 minutes after the dump turbidity in the major proportions of the water column was at pre-dump levels. Furthermore, the material settled as a "density current" rather than as individual particles. A small residue remained near the bottom for longer periods. An additional study (New England Aquarium, 1974) indicated that the effects of turbidity were sub-lethal. These studies suggest that the impacts to water quality resulting from actual turbidity will be minimal.

5.2 Marine Ecosystem

Benthic Communities and Phytoplankton. The major direct impact on the

benthic communities of the proposed dredging and disposal will be their physical destruction. This destruction will result from the actual dredging operation in Stamford Harbor. Destruction at the disposal site will result from the covering-over of benthic forms by the dredged material. Again, the actual manner in which the material accumulates on the bottom is almost impossible to predict. Organisms that are unable to burrow to the surface of the sediments will be completely destroyed. Other may be affected by siltation. The degree to which siltation destroys or otherwise interferes with benthic forms is dependent upon the rate at which materials and the degree to which it alters respiration and feeding. Turbidity has been recognized as interfering with respiration and feeding among various marine organisms by Saila et al., (1971), and Johnson (1972) and Hollis et al., (1964). However, a laboratory study indicates that the effects of turbidity may be sub-lethal to benthic forms (New England Aquarium, 1974).

The rate at which recolonization will occur in areas where populations have been reduced or destroyed will depend on local conditions at each site. These conditions include quality of the sediments exposed, the extent of remaining numbers of the impacted populations within the general area and physical nature of the new substrate. It is difficult at this time to determine whether the above represent short- and long-term impacts. Rhoads (1974) suggests that recolonization is completed within two years in most cases following disposal operations. This would represent a short-term impact.

The potential secondary impacts which may result from the proposed dredging and disposal could be of major significance. Benthic and plankton forms may suffer from the release of toxic compounds, heavy metals and high BOD loading resulting from the dredging and disposal operations. In areas where such materials are concentrated, coves and bays for example, the impacts could be substantial. Death could result to organisms present or the compounds may be concentrated in the food chain with even more severe implications. It is expected that such impacts will not be realized due to dilution of these constituents. Impacts to benthic and planktonic forms at the dredged and disposal sites are expected to be short-term.

Finfish. The most significant impact associated with finfish that is likely to occur is the destruction of the eggs of demersal species (Loosanoff and Tommers, 1948; Davis and Hidu, 1969). Such destruction could represent a long-term impact. Since fish would tend to swim away from the dredging and dumping activities, they are not expected to suffer any permanent effects. It is possible that some forms, especially bottom forms such as the flounder, may experience some mortality from the physical dumping action. In addition, the release of toxic compounds, siltation and turbidity may have a localized impact on forms that may be present in the upper portion of the East Branch. It is doubtful, however, that many fish species proceed any great distance into the East Branch considering existing conditions.

Other short-term impacts to the finfish communities that may result from either the dredging or disposal actions include respiratory difficulties due to turbidity and siltation. In addition, certain organisms that serve as food for various species of fish may be destroyed in the immediate area forcing the fish to search elsewhere for a new supply of food. Such a situation, however, is not expected to result in the desertion of either the dredging or disposal grounds by species currently inhabiting these areas.

The major potential for long-term impacts to finfish is associated with the potential release of toxic compounds such as heavy metals, pesticides, etc. from the sediments and their concentration in the food chain. This represents a potential impact on man himself if any of these species are eventually consumed by humans.

Shellfish and Lobsters. The proposed project represents a potential impact to the lobster and shellfish populations in the dredged and disposal area. Turbidity and siltation may affect both species by interfering with their respiration. The extent of interference depends on the degree of turbidity and siltation. It is expected to be of short-term duration. In certain localized areas where high concentrations of suspended materials results in a high rate of siltation the impact could be expected to be of greater significance and possibly fatal. The area where this is most likely to occur is in the upper portion of the East Branch where currents and general water movements are likely to be insufficient to dilute suspended material rapidly.

In addition, impacts from turbidity and siltation are likely to be greater on the shellfish populations that on the lobsters. The former are not as able to move away from stressed areas and are thus at the mercy of natural forces. High turbidity and siltation may also interfere with the feeding mechanisms of the filter-feeding bivalves long before the lobsters experience the same stress (Loosanoff and Tommers, 1948). However, the results of the New England Aquarium (1974) suggest that the effects of turbidity would not be lethal to these species.

Short and long-term impacts on shellfish and lobsters are also likely to occur at the disposal site. There is a greater potential here for the burial of benthic populations including these species as a result of the direct dumping operations. The sudden deposition by very high quantities of dredged material would result in the destruction of sessile forms such as bivalves. It is also probable that a motile form such as a lobster could not escape the deluge of dredge material raining down on the area fast enough to save itself. Local current conditions in the disposal area at the time of disposal would control the dispersal of material over the area. In areas where the material does not completely bury motile forms, they may be expected to escape with only minimal short-term impacts.

The greatest potential impact associated with the proposed dredging and disposal operations is the release and uptake of heavy metals and other toxic compounds. Saila et al., (1968) report that lobsters can tolerate high concentrations of suspended material as great or even greater than those that are likely to result from the disposal of dredged material with no adverse effects. He reports the major concern is with toxic compounds and the resulting mortality following their uptake. Because of the nature of the food chain this potential impact is of major significance with respect to the other species in the area as well as man himself.

6.0 ALTERNATIVES TO THE PROPOSED ACTION

6.1 Alternative Disposal Sites. As previously discussed, there are 19 historical disposal sites within the Long Island Sound Area. These have been reduced to four. They consist of: New London, New Haven, ~~Con-~~ Cornfield Shoals off the Connecticut River and ~~Eatons Neck~~ Western LIS & Compass Rose site. The selection of the [redacted] Compass Rose Disposal Site was based on several factors. With respect to the maintenance dredging of Stamford Harbor, it is closer than any of the other sites and is therefore best from an economical consideration. The ~~Eatons~~ Neck Site also satisfies the requirements for locating a disposal area as established by ~~WES~~ for the DMRP.

Land disposal as an alternative here is not considered for two principal reasons. First, an adequate site could not be located. As indicated earlier,

this is the responsibility of local agencies. This lack of an adequate site made disposal in the water necessary. Secondly, in view of the fact that the proposed maintenance dredging fits very well into the DMRP, disposal at Eatons Neck is preferable.

6.2 <u>No Project Alternative</u>. The "No Project" alternative, if implemented, would have long-term detrimental implications with respect to Stamford Harbor and the DMRP. As indicated earlier, the maintenance dredging of Stamford Harbor will reduce waiting time of large commercial and recreational vessels now required due to impossible passage in certain areas of the harbor at the time of low water. This waiting time is costly and can be hazardous. In addition, the maintenance dredging associated with the proposed project will eliminate hazardous conditions due to shoaling within the harbor, especially in the East Branch. Thus the "No Project" alternative is not in the best interests of the current utilization of the harbor and adjacent shoreline.

In terms of the DMRP, the "No Project" alternative would represent a substantial setback to the overall WES program. The information to be gathered as a result of the project is considered invaluable. Thus the "No Project" alternative is not in the best interest of the DMRP and ultimately the marine ecosystem and its beneficial use to man.

7.0 RELATIONSHIPS BETWEEN SHORT-TERM AND LONG-TERM GAINS AND LOSSES

The major relationships between short- and long-term gains and losses associated with the proposed project are primarily directed toward environmental impacts. There are certain short-term gains in terms of employment of individuals to accomplish the assigned project tasks. The implications of such short-term gains are difficult to measure since it is impossible to identify how project-associated employment involves the overall economy of individuals connected with the program. It is also probable that long-term economic gains may be realized by individuals directly associated with the program. In addition, long-term economic gains may also result from the implementation of the project with respect to the immediate Stamford area. Likewise, long-term economic losses may result if the project is not conducted. Again, such long-term losses would be most readily felt by the recreational boating interests in the harbor as well as those concerns which depend on commercial boating.

There are certain short-term losses associated with the implementation of the project with respect to environmental impacts. Destruction of habitat and associated marine organisms, increased turbidity, alteration of water quality and its implications in the study area and the covering of benthic forms at the dump site are considered short-term losses or impacts. Again, it is felt that these impacts are not irretrievable and that pre-dump conditions

physically, chemically and biologically will return with time. The major long-term loss associated with the environmental aspects of the entire area relate to toxic compounds. The greatest impact associated with the release of toxic compounds or heavy metals lie in the possibility of such materials being taken up by the organisms in the area. The long-term loss could be associated with the loss of large numbers of organisms or populations due to death and the concentration of toxic compounds in the food chain and the potential for impact from human consumption. This situation is not expected to occur on a large scale and possibly not at all. Thus, this should not be considered to be a definite long-term loss.

Major gains to be realized from the implementation are long-term. Specifically, the maintenance dredging of Stamford Harbor will increase navigation safety for commercial and recreational vessels and will insure continued usage of the harbor and its facilities. Thus, the economy of the area supported by commercial and recreational boating should not suffer because boating went elsewhere due to impossible waters. In addition to these gains, the results of the DMRP must also be considered long-term gains. By understanding the direct and indirect impacts to the aquatic and marine ecosystem for dredged-disposal operations, the stability of these environments will be enhanced.

8.0 ANY IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES WHICH WOULD BE INVOLVED IF THE PROPOSED ACTION SHOULD BE IMPLEMENTED

The implementation of the proposed dredging and dredged material at Stamford Harbor and Eatons Neck Disposal Site, respectively, will involve the commitment of capital and labor that will be irreversible and irretrievable. These are viewed as the only permanent commitment of resources. The destruction and disturbance of habitat at either site does not necessarily represent commitments of this magnitude since it is expected that sediments at both locations will return to suitable substrate for in situ populations to use. The dredging and disposal operations will result in the irreversible commitment of local representatives of some biological populations. This commitment, however, is not considered irretrievable since repopulation and recolonization is expected to take place in both areas.

The resources of Stamford Harbor are in essence committed to commercial and recreational activities. This includes boating as well as industry in the immediate area. The quality of the environment within the harbor has undergone severe degradation as a result of these activities. It is not known at this time whether such degradation or commitment is either irretrievable or irreversible. It is unlikely that the proposed operation represents an equal commitment with respect to overall water quality.

The disposal operation is not likely to result in irretrievable or irreversible commitments with respect to overall water quality at Eatons Neck or Long Island Sound. It is expected that conditions will return to pre-disposal levels within a short period of time and in some cases almost immediately.

It is the objective of the proposed DMRP to identify irretrievable and/or irreversible commitments of natural resources - physical, chemical and biological - that may result from dredge-disposal operations. Such information will benefit both the marine ecosystem and the interests of man.

9.0 COORDINATION

The proposed dredging and dredged material disposal project has been coordinated with a number of Federal, State and private organizations. A list of contacts appears below:

(1) Mr. Hillard Bloom
Private Citizen with Fisheries Interests
Norwalk, Connecticut

(2) William F. Clapp Laboratories of
Battelle Memorial Institute
Duxbury, Massachusetts

(3) Connecticut Department of Agriculture
Aquaculture Division
Milford, Connecticut

(4) Connecticut Department of Commerce
Hartford, Connecticut

(5) Connecticut Department of Environmental Protection
Hartford, Connecticut

(6) Connecticut Shellfish Commission
Hartford, Connecticut

(7) Connecticut State Water Resources Commission
Hartford, Connecticut

(8) Massachusetts Department of Natural Resources
Marine Fisheries Division
Salem, Massachusetts

(9) National Marine Fisheries Service
Gloucester, Massachusetts

(10) National Marine Fisheries Service
Milford, Connecticut

(11) New York State Department of Environmental Conservation
New York, New York

(12) Northeast Utilities Service Company (NUSC)
Hartford, Connecticut

(13) University of Connecticut
Marine Laboratory
Noank, Connecticut

(14) U. S. Army Corps of Engineers
Waterways Experiment Station
Vicksburg, Mississippi

(15) U. S. Department of Health, Education and Welfare
Public Health Service
Winchester, Massachusetts

(16) U. S. Environmental Protection Agency
Region I
Boston, Massachusetts

(17) U. S. Environmental Protection Agency
Region II
New York, New York

(18) Yale University
Department of Geology - Geophysics
New Haven, Connecticut

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